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ABSTRACT

The author distinguishes between the terms "physical fitness" and "motor performance," summarizes the health and physical status of adults, surveys the physical fitness status of children, and proposes a lifestyle approach to the development and lifetime maintenance of health and physical fitness. The distinctions between "physical fitness" as related to functional health, and "motor performance," related primarily to athletic ability, are expanded upon. An examination of the current health and fitness status of adults centers on examination of (1) heart and cardiorespiratory diseases, (2) undesirable body composition (obesity), and (3) musculoskeletal factors related to low-back pain. Emphasis is made that disease processes that may or may not manifest symptoms in adults frequently begin in infancy and childhood. Risk factors in children for later development of coronary artery disease are discussed. Methods of developing lifestyle patterns for the prevention of atherosclerosis and the promotion of cardiovascular health are suggested. (MJB)

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WHAT CURRENT RESEARCH TELLS US ABOUT PHYSICAL FITNESS FOR CHILDREN

by

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I. Overview of Presentation

The basic approach and outline of this presentation will be: to distinguish between the terms physical fitness and motor performance; summarize the health and physical fitness status of adults; survey the physical fitness status of children; and, to propose a lifestyle approach to the development and lifetime maintenance of health and physical fitness.

II. Definition of the Terms Physical Fitness and Motor Performance

Over the years there has been a proliferation of tests purporting to measure fitness and performance capacities. This has contributed to confusion on the part of the American population because the tests which make up a particular test battery contribute to the development of concepts about physical fitness. In 1975, a joint committee representing the Physical Fitness, Measurement and Evaluation, and Research Councils of ARAPCS was given the charge of preparing a position paper that would be a basis for a revision of the AAHPER Youth Fitness Test Battery, and thus more clearly differentiate the areas of physical fitness related to functional health and motor performance related primarily to athletic ability. After numerous meetings and revisions of drafts, the final position paper was presented at the Seattle AAHPER convention in March 1977.

A. Physical Fitness

Physical fitness was considered a multi-faceted continuum which measures the quality of health ranging from death and diseases that severely limit physical activity to the optimal functioning of various physical and health aspects of life. In short, physical fitness capacities are areas identified with dynamic functional health. Test of physical fitness should reflect the following characteristics:

1. There should be evidence that they are essential to one's health and well-being.
2. They should extend from severely limited dysfunction to high levels of functional capacities.
3. They can be improved with appropriate physical activity.
4. Changes in functional capacity are accurately reflected by changes in test scores.

Based on these criteria, the committee recommended that the following physical attributes be labeled physical fitness capacities: cardiorespiratory function, body composition, abdominal and low-back musculoskeletal function. These physical abilities exhibit variations in capacity along the established continuum. There are sufficient data to suggest that regular physical activity can cause improvements in cardiorespiratory function and body composition. There are limited data and opinions that musculoskeletal dysfunction in the abdominal and low-back region is related to low-back pain and tension.

B. Motor Performance

Motor performance capacities are those related primarily to task-specific motor traits and athletic ability. Tests of motor performance are: speed, agility, power, coordination, balance, movement time, reaction time, etc. These capacities were not considered essential to life-long health and well-being, but the committee recognized the importance of athletic achievement in school-age individuals, as well as the need for selected abilities to handle the regular physical education classes. Since concepts are developed and communicated through testing, the committee recommended that tests of motor performance not be included in a physical fitness battery. It was recommended that teachers utilize

basic physical fitness tests which are related to positive health in each area mentioned earlier. Since speed, agility, and power are included in the present AAHPER Youth Fitness Battery, it was recommended as one source for tests of motor performance.

It is extremely important for teachers and others administering physical and motor performance tests to distinguish the purpose and significance of each test battery they are utilizing.

III. Health and Physical Fitness Status of Adults

Many of the degenerative diseases which afflict the adult population have their genesis in infancy and childhood. These and related diseases can be placed in the three major physical fitness categories described earlier: (1) heart and cardiorespiratory diseases, (2) undesirable body composition -- obesity and (3) musculoskeletal factors related to low-back pain.

A. Heart and Cardiorespiratory Disease

More than 600,000 deaths occur each year as a result of coronary artery disease (CAD). Over 1,000,000 deaths per year or approximately 54% of all deaths in this country are related to deficiencies in the heart and cardiovascular system, i.e., CAD, stroke, congestive heart failure, etc. These diseases are insidious and have multiple causes and a variety of precipitating agents, many of which are still little understood. For example, with rare exception, symptoms or evidence of CAD is not present unless at least two of the three major coronaries are more than 75% narrowed in cross-sectional area. The common factors which have been identified as increasing one's risk of heart and cardiorespiratory disease are summarized below:

1. Hypertension. About 23 million adult Americans (approximately 18% of whites and 37% of blacks) have high blood pressure and most people

think of this as a disease of old age. Doctors now realize that the problem has its roots in childhood. Some 15% of American children are destined to develop high blood pressure as a result of genetic inheritance, diet, weight, lifestyle, responses to stress, and probably as yet unidentified factors. Few entirely new cases of hypertension evolve after age 30. It is an insidious problem that may cause no symptoms for decades. If left untreated, it greatly increases the risk of developing three of the nation's leading killers and cripplers -- CAD, stroke, and kidney failure. Hypertension's affect on the atherosclerotic process in the arterial wall is that it is known to cause: mechanical stretching of the vessel wall which allows transport of products through the cell membranes that normally would not penetrate, (b) increased cell permeability, (c) increased cell (smooth muscle) proliferation.

Children are just as likely as adults to suffer damage caused by hypertension and in fact the earlier in life the problem starts the more severe the consequences. However, in nearly all cases the risk can be greatly reduced by effectively controlling high blood pressure through a combination of diet, especially reducing salt intake, weight loss -- to an acceptable body composition, exercise and if necessary medication.

2. Smoking. An estimated 30 million Americans have stopped smoking since the Surgeon General's report was issued in 1964. However, 54 million Americans are presently smoking, which is responsible for 325,000 premature deaths each year, including at least 90 percent of the 90,000 deaths from lung cancer. There is also a strong association between smoking and incidence of CAD, emphysema, and chronic

bronchitis. The effect of smoking on the atherogenesis process is to (a) increase vessel wall permeability and (b) cause abnormal cell growth due to tobacco toxins.

The estimated 54 million Americans aged 13 or older who smoke are a dwindling minority. The number of adult smokers has fallen from 42 percent in 1964 to 34 percent today. Among men it has fallen from 52 percent to 39 percent and among women from 32 percent to 29 percent. But with the population growing, annual consumption of cigarettes has climbed from 511 billion to a record 616 billion in 1976 or more than 1½ packs a day per smoker (about $260 per smoker each year). Surveys have found that nine out of ten smokers would like to quit, and most have tried at least once or say they would if there was an easy way to stop, according to the National Clearinghouse for Smoking and Health.

3. Hyperlipidemia and Hyperlipoproteinemia. These lipid disorders have been implicated as major contributors to atherogenesis. The influence of this risk factor on atherosclerosis is to: (a) lead to lipid (cholesterol) deposition and (b) as long as these lipid abnormalities are present, this causes an injury in the endothelium similar to a scab on the surface of the body on the skin. There are two cholesterol pools in the body and the more important one, pool B, includes deposits in the arterial wall and a greater influx than efflux leads to a decreased lumen circumference reducing blood flow through the artery. Serum cholesterol concentration has an almost linear relationship to the risk of developing CAD, i.e., the risk is continuous and the greater the cholesterol level the greater the risk of CAD. Inherited hypercholesterolemia (Type 2) is a genetic disorder which may clinically appear early in childhood and is associated with

early premature CAD and death in young, middle-aged adults (one to two percent of upper middle-class caucasians are affected by this type of hypercholesterolemia).

A recent review of studies shows that the higher the levels of serum cholesterol the greater the risk of CAD and the more effective increased physical activity is in lowering the cholesterol level. Dynamic, vigorous physical activity such as cross-country running, cycling and swimming is more effective than static exercise in lowering serum cholesterol levels and hence CAD risk.

Recent evidence indicates that the plasma liproproteins may be important in the process of atherosclerosis. It is believed that low-density lipoprotein (LDL) is involved in the influx of cholesterol into the arterial wall and that the high-density lipoproteins (HDL) remove cholesterol from the arterial wall to the liver for excretion or utilization for production of hormones, etc. Women have higher (10 mg. % on the average) HDL than men and this is believed to be one of the protective mechanisms for reduced CAD in females. Women runners have been shown to have higher HDL than controls of the same age. The Framingham study demonstrates a higher incidence of CAD in individuals with high LDL, lower incidence of the CAD in individuals with high HDL. Exercise appears to cause a beneficial shift in the HDL/LDL ratio, i.e., increase HDL and lower LDL.

4. Physical Activity. A study by the President's Council on Physical Fitness and Sports in 1972 indicated that the American public was confused about their physical activity needs and this confusion, at least in part, could have been related to the mixture of test batteries utilized for testing physical and motor performance capacities in the

past. The study indicated that 45 percent of all adult Americans (49 million adult men and women) did not engage in physical activity for the purpose of exercise. Many have looked at the positive side of this survey by emphasizing that 55 percent do claim physical activity. However, a much smaller percentage would meet the minimum requirements of physical activity per week, i.e., frequency at least three times a week, duration - at least 20-30 minutes each session, intensity - at least 60 percent of symptoms limited maximum. The real paradox of the study was that 63 percent of the non-exercisers indicated they got enough exercise, while only 53 percent of the exercisers thought they were as active as they should be. Commercial health spas, YMCA's, and community agencies attracted about three percent into their exercise programs.

In 1977, a Gallup poll asked Americans whether they participated in any daily, non-work oriented physical activity designed to keep them physically fit, and if the answer was affirmative, whether that daily activity included jogging. In 1961 when the same questions had been asked, only 24 percent of the sample had replied affirmatively. In 1977, a surprising 47 percent gave a positive reply with almost no difference existing in the numbers of males (50 percent) and females (45 percent). Twenty-four percent of those who worked out daily were joggers, which is a projected 11 percent of all Americans and 74 percent of these joggers go at least one mile a day.

It would be nice to think that the allied health professionals and our attempts at teaching the why, what and how of physical fitness have contributed to this rise in exercise habits by the American population. Although it is impressive that in just 16 years the

number of those getting daily physical activity has almost doubled, it is important to realize that more people still don't exercise (53 percent) than do (47 percent). Three recent studies have created new interest in the potential benefits of exercise in reducing risk of death from CAD and particularly sudden death.

The first study was conducted on 17,000 British civil servants. Workers were asked on Monday to recall the exercise in leisure time for the previous Friday and Saturday. Activity was divided into vigorous and non-vigorous categories with 7.5 kilocalories per minute and above considered vigorous exercise. Examples of vigorous activity were swimming, keeping fit exercises, heavy work such as tree chopping, jogging, cycling, and climbing more than 500 stairs a day. This energy output would be equal to about 450 kilocalories per hour. Individuals reporting vigorous exercise had 1/3 less risk of coronary heart disease than those reporting non-vigorous exercise in leisure time. The investigators further randomly sampled 509 individuals from the 17,000 group and conducted more intensive studies. They found that 25 percent of those randomly sampled individuals reported vigorous exercise and that there were fewer ECG abnormalities occurring in those individuals reporting vigorous exercise. One of the conclusions of this particular study was that one of the protective mechanisms in reducing the incidence of death from CAD was that vigorous exercise prevents or diminishes the chain of events which lead to arrhythmias or abnormal heart beats which are known to precipitate heart attacks or cardiac arrest.

The second study was by Paffenbarger and was conducted on work activity of longshoremen. These longshoremen were categorized into

heavy, moderate and light work activities. The men in the heavy work categories (1800 Kcal above normal calorie requirement in eight-hour day) were found to have protection against sudden death in particular and had a reduced risk of death from coronary artery disease.

In the third investigation, Paffenbarger studied 17,000 Harvard alumni (men 35-75 years of age) and found there were fewer heart attacks among those who engaged regularly in strenuous physical activity such as jogging, swimming, tennis and mountain climbing, than among those who were less active. This was the first study on Americans to demonstrate that strenuous leisure time exercise has a definite protective effect, even if other characteristics such as high blood pressure and overweight were present. Physical activity was largely independent of other risk. Protection was evident for those who engaged in intense physical activities for at least three hours a week or at least 2000 kilocalories per week gained through this amount of exercise. Lesser amounts of exercises (such as light sports -- bowling, baseball, biking or just leisurely biking, boating and golf) had no measurable benefit in reducing risk for heart attack. They were no better than those who were inactive. Those on the low side of 2000 kilocalories per week expenditure in exercise had 64 percent higher risk of suffering a heart attack. Varsity athletes as students were not protected against heart disease in their adult years unless they continued a high level of physical activity. Those who were not athletes while in college had reduced risk of coronary artery disease if they took up strenuous activities later in life.

It is known that strenuous activity benefits the heart function and reduces cardiac risk in a number of ways causing more efficiency

of the heart leading to the ejection of more blood per beat, decreasing blood pressure, decreasing the level of triglycerides and reducing tendency of the blood to form clots.

5. Health Practice. Elevated risk in various factors have an additive effect on overall risk for CAD. For example, if one has moderate risk in 2 or 3 areas this may be more important than high risk in one area. There is an ongoing study in California on various health practices and the potential benefit on health. Lowest mortality rates have been found in those who sleep 7-8 hours, who eat breakfast on a regular basis, who seldom snack, weigh within 10 percent of desirable weight, who engage in physical activity, drink alcoholic beverages none or moderately and who never smoke. The highest mortality rate, on the other hand, are found in those with weight outside 10 percent of desirable, smoke, who are physically inactive, eat no breakfast, frequently snack, sleep -- females more than 9 hours and males less than 5 hours, who drink moderately or heavily. Significantly, after the age of 45 life expectancy increased with the number of health practices followed. One of the leaders of this particular study, an M.D., made the statement that our daily habits have more to do with sickness and death than all medical influences.

There are a number of other risk factors related to coronary disease, but it is not possible to cover all of these factors in this presentation.

B. Undesirable Body Composition -- Obesity

Despite the adverse effects on health, social stigma, and the proliferation of "fat" reducing industries, obesity shows no sign of declining. Adults weigh more today than 10 or 15 years ago. Ten to thirty

percent of all Americans weigh at least 30 percent more than their "ideal weights." Obesity is associated with education, sex, race, social class, heredity, psychological factors and inactivity. Children or adopted children of obese parents grow fatter and fatter until by the time they reach the age of 17, they are three times as fat as those of lean parents.

Investigators have presented evidence that people who become fat as infants and who remain fat may have more fat cells than people who become fat as adults. In lean children, fat cells proliferate during the first two years of life, remain constant in number from age 2 to 10 then proliferate again from age 10 to 16. Fat cells in obese children increase almost continuously from birth to age 14 or 16.

Obesity seems to be a coexisting factor associated with four types of hazards to health. These include (1) disturbance of normal bodily function, i.e., lower pulmonary capacity, diabetes, decreased flexibility, and accelerated wear and deterioration of joints; (2) increased risk of developing certain diseases, i.e., increased risk of death in a number of disease categories; (3) detrimental effects on established diseases, i.e., hypertension, heart, cerebral vascular diseases, gall bladder; (4) adverse psychological effects, i.e., inferiority, self blame and lack of advancing socially through marriage.

C. Musculoskeletal Function

The maintenance of minimal levels of trunk and hip strength/endurance and flexibility is believed to be important in the prevention and alleviation of low-back pain and tension. While there is a dearth of hard research in this area, there is clinical evidence and many physical fitness proponents, physical therapists and orthopedic surgeons link the high incidence of low-back problems with a corresponding lack of exercise. The

general logic is that weak muscles which are easily fatigued and/or strained cannot support the spine in proper alignment. Weak abdominal muscles, in particular, allow the pelvis to tilt forward causing a concurrent and abnormal arch in the low back. Shortened, inflexible muscles result in the decreased mobility and increased possibility of strain, spasm and pain. When tense muscles shorten, loose elasticity and are weakened by lack of exercise, the "low-back syndrome" follows. Estimates of the magnitude of this problem range from approximately 16 percent of the population who have suffered the classical low-back pain syndrome to somewhere closer to 80 percent who have had "simple but significant backache." Back injuries may well count for more lost man-hours than any other occupational injury.

IV. Physical Fitness Status of Children

Emphasis has been given to the fact that the disease process which may or may not be manifested by symptoms in adults begins in infancy and childhood. Recent studies have examined the prevalence of CAD risk factor in children.

CAD Risk Factors in Children

Blumenthal has suggested that the following factors be considered in the identification of "high risk" children.

1. Children with
   a. Hyperlipidemia
      1) Primary
         Familial
         Nonfamilial
      2) Secondary
         Nephrosis
         Hypothyroidism
   b. Hypertension
   c. Diabetes
   d. Obesity

2. Offspring of adults with
   a. Hyperlipidemia
   b. Essential Hypertension
   c. Diabetes
   d. Premature myocardial infarction

Blumenthal indicated that children identified as being a high risk should be given appropriate advice and continuing counseling concerning excessive habits, diet and cigarette smoking.

The prevalence of single and multiple CAD risk factors were accessed in active children, 7 to 12 years of age. The table below lists the criteria for increased risk and the prevalence of each risk factor in 32 boys and 15 girls who were participants in a summer youth fitness camp.

Criteria	Total	% Prevalence in Total Sample
Obesity - % Fat >20%	9 (47)	19.1
>25%	5 (47)	10.6
Low Work Capacity		
Peak $\dot{V}_{O_2}$ <31 ml/kg/min	4 (36)	11.1
Elevated Blood Lipids		
Cholesterol >200 mg %/100 ml	4 (38	10.5
Triglycerides >100 mg %/1000 ml	7 (38)	18.0
Cholesterol and Triglycerides	2 (38)	5.0
Electrophoresis Lipoprotein		
Classification		
II - - - - - - - - - - - - - - -	2 (38)	5.0
IV - - - - - - - - - - - - - - -	7 (38)	18.0
Family History[a]	12 (47)	25.5
Coronary Disease	6 (47)	(12.8)
Elevated Blood Cholesterol[b]	6 (47)	(12.8)

[a]History of CAD and related diseases

[b]This was determined by the family's physician

The results of the study substantiates the prevalence of CAD risk factors in children and that development of multiple risk factors occur at any early age (see table below)

Frequency of Single and Multiple Risk Factors Identified in Chidren, Ages 7-12 (N = 47)

Number of Risk Factors Identified[a]	Frequency	Percent of Total Frequency
1	12	41.4
2	7	24.1
3	6	20.7
4	3	10.3
5	1	3.5
	Total 29	Total 100.0

[a]Includes the incidence of family medical history of CAD and related diseases.

Wilmore and McNamara surveyed the risk factor prevalence in boys 8 to 12 years of age. The following table lists the criteria for "high risk" and prevalence in each area.

Risk Factor	Prevalence	Relative Prevalence (%)
Hypertension		
Systolic >140	0	0.0
>123-130*	0	0.0
Diastolic >90	0	0.0
>74-79*	3	3.2
Obesity		
Relative Fat >20%	36	37.9
Relative Fat >25%	12	12.6
Abnormal ECG		
Rest	2	2.1
Exercise	3	3.2
Elevated Blood Lipids		
Cholesterol >200 mg %	19	20.0
Triglyceride >100 mg %	8	8.4
Lipoprotein Electrophoresis, Type II	2	2.1
Family History[+]		
Heart Attack	52	54.7
Heart Attack ≤60 yrs. of age	32	33.7
Heart Attack ≤50 yrs.	15	15.8
Low Work Capacity		
$\dot{V}_{O_2}$ max <42 ml/kg/min	3	3.2
Diabetes	0	0.0

*Age dependent 80th percentile, data from Londe

[+]Includes father, mother, uncles, aunts, grandparents, and greatgrandparents

Allied health professionals responsible for the care of children should recognize the importance of familial aggregation of risk factors, and inquire concerning the existence of such factors in parents and first degree relatives. Relatives of individuals with premature CAD have significantly increased risk of early onset of the disease. Many risk factors are known to aggregate in families, including elevation of serum lipid values and of arterial pressure, diabetes mellitus, obesity, and cigarette smoking. Familial aggregation may result from environmental or genetic factors or both.

The Netherlands has begun a primary prevention program in school children with comparative studies of socioeconomic and cultural characteristics in contrasting regions. An 88% participation rate has yielded the following results:

Prevalence of "High Risk" in Serum Cholesterol
in Netherlands School Children (Aged 7-12)

	N	≥200 mg %	≥220 mg %
Boys	490	22%	8%
Girls	413	26%	8%

Body Fatness* By Skinfold in
Netherlands School Children

	Obese	Fat	Lean
Boys	5.5%	10.5%	84%
Girls	5.5%	17.6%	77%

*20 and 25% cutoff points were used for fat and obese categories.

The investigators concluded that it is feasible to study atherosclerosis precursors in school children and that it is justified to study the relationship between atherosclerosis precursors and their determinants. Since a high proportion of Dutch schoolchildren have an unacceptably high risk it was felt that real primary prevention implies the modification of determinants of a high risk profile as early in life as possible.

Although the percentage of smokers has declined in the adult population, teenagers and children are initiating the habit at younger and younger ages. The table below indicates the trend a few years ago.

Teenage Smoking 1968 vs 1970
Percent Smokers

Age	Boys		Girls	
	1968	1970	1968	1970
12	1.3	2.2	0.3	0.6
13	1.6	3.7	0.6	2.1
14	5.6	10.9	0.9	6.1
15	13.6	16.5	7.4	12.4
16	20.3	22.4	11.9	16.3
17	25.6	32.3	15.7	17.5
18	35.5	42.5	21.3	27.8
All 12-18	14.7	18.5	8.4	11.9

A pediatrician, Glenn Friedman, has formed a non-profit organization (Health Evaluation and Longevity Planning - H.E.L.P.) to provide low cost personalized risk factor testing. Data on cholesterol in children have been collected on a large sample of children and adults which are summarized below:

Elevated Cholesterol Values in Arizona Children 1975-76

N		160-199 mg%	>200 mg%
(1231)	Private Pediatrician Practice	43%	10%
528	Riverside School	46%	7%
686	EPSDT Pilot Program	49%	7%
103	Motorola (HELP)	53%	11%
1045	Tucson School (HELP)	54%	15%
719	San Diego School (HELP)	53%	10%
79	PCS (HELP)	47%	8%
4612	Arizona St. Dept. of Health Service	44%	15%
9006	Average of Ariz. Children	47%	13%
4592	Adult	(200-249) 39%	(>250) 17%

Results from various studies over the years indicate that cholesterol concentrations at various ages are:

. Neonate - 65 mg/dl

. Gradual increase to 2 yrs. to 165 mg/dl

. No further significant variation with age, sex, rate of growth or motivation until age of 20

. Slow progressive rise until 60 yrs. of age

The Muscatine, Iowa study investigated risk factor in 4,829 school children 6-18 years of age. The most significant findings were:

. Serum cholesterol levels similar at all ages

Mean = 182 mg/dl
24% $\geq$ 200 mg/dl
9% $\geq$ 220 mg/dl
3% $\geq$ 240 mg/dl

. Casual level of triglycerides increased with age

6 yrs = 71 mg/dl $\pm$ 36
18 yrs = 108 mg/dl $\pm$ 45
15% had $\geq$ 140 mg/dl

. Blood pressure increased strikingly with age

6-9 yrs	None	Systolic $\geq$ 140 mmHg Diastolic $\geq$ 90 mmHg
14-18 yrs	8.9%	Systolic $\geq$ 140 mmHg
	12.2%	Diastolic $\geq$ 90 mmHg
	4.4%	Both at or above these levels

. Obesity increased through the school years (triceps skinfold)

6-9 yrs - 20% had wts. relative to those of group as whole of $\geq$ 110%
- 5% had wts. $\geq$ 130%

14-18 yrs - 25% relative wt. of $\geq$ 110%
8% relative wt. of $\geq$ 130%

These data indicated that a considerable number of school-age children have risk factors which in adults are predictive of CAD.

V. Lifestyle Patterns for Life-Long Health and Physical Fitness

Listed below are reasons why Friedman believes atherosclerosis prevention should begin in the child.

- Associated "risk factors" begin in this age period (patterns of living are established in childhood).
- Atherosclerosis develops in the child.
- Atherosclerosis may be more "reversible" in the young.
- Reduce "risk factors" in the child ⟶ reduce "risk factors" in the parent.

Two investigators, Kannel and Dawbar, who have been closely associated with the Framingham study on the epidemiology of CAD, encourage the following measures for the promotion of cardiovascular health:

- Prevention of obesity
- Early detection of lipid abnormality and correction by diet and/or other procedures
- Early detection of hypertension and implementation of corrective measures
- Promotion of high energy output physical activity
- Discouragement of the cigarette smoking habit

Since all behavior is a product of ongoing processes, education for positive health practices is a life-long task requiring equal attention to early and later education, and to environmental and individual factors. We must educate in terms of multiple causes and recognize that a variety of precipitating agents, including our behavior, may serve as precursors of disease. The development and maintenance of life-long health and physical fitness will depend on consistency in what is taught by and "caught" from allied health professionals in the following areas:

A. Definitions of physical fitness and motor performance.

B. Personal example -- we shouldn't be recognized as clanging cymbals.

C. Our environment must be conducive to physical activity without undue danger.

D. We should become more active in communities available for continuing education.

E. We must recognize the most effective means of communication and utilize them to their fullest potential.

F. The concept of multiple causes must be driven home, otherwise all our messages will be discredited.

SELECTED REFERENCES

"A Position Paper on Physical Fitness," Joint Committee representing the Measurement and Education, Physical Fitness and Research Councils of ARAPCS, Andrew S. Jackson, Chairperson (unpublished manuscript presented at the AAHPER Convention in Seattle, 1977.

Blumenthal, Sidney. "Prevention of Atherosclerosis," The Am. J. of Cardiology, 31:591-594, 1973.

Blumenthal, Sidney, et al. "Risk Factors for Coronary Artery Disease in Children of Affected Families," The Journal of Pediatrics, 87:1187-1192, 1975.

Editor Column. "Atherosclerosis, Cholesterol, and the Pediatrician," The J. of Pediatrics, 80:693-696, 1972.

Epstein, L. "Vigorous Exercise in Leisure Time, Coronary Risk-Factors, and Resting Electrocardiogram in Middle-Aged Male Civil Servants," British Heart Journal, 38:403-409, 1976.

Gresham, G.A. "Is Atheroma A Reversible Lesion?" Atherosclerosis, 23:379-391, 1976.

------- "Health Practices and Physical Health Status," Physical Fitness Research Digest, PCPFS (edited by H. Harrison Clarke) April 1976.

HSIA, S.L. "Decreased Serum Cholesterol-Binding Reserve in Premature Myocardial Infarction," Lancet, 1000-1004, November 22, 1975.

Kannel, W. D. and T. R. Dawber. "Atherosclerosis As a Pediatric Problem," The Journal of Pediatrics, 80:544-554, 1972.

Lauer, Ronald M., et al. "Coronary Heart Disease Risk Factors in School Children: The Muscatine Study," The Journal of Pediatrics, 86:697-706, 1975.

Leventhal, Howard. "Changing Attitudes and Habits to Reduce Risk Factors in Chronic Disease," The Am. J. of Cardiology, 31:571-580, 1973.

Londe, S. "Blood Pressure Standards for Normal Children as Determined Under Office Conditions," Clinical Pediatrics, 7:400, 1960.

Morris, J.M. "Vigorous Exercise in Leisure-Time and the Incidence of Coronary Heart-Disease," Lancet, 1:333-339, 1973.

Paffenbarger, Ralph S. and Wayne E. Hale, "Work Activity and Coronary Heart Mortality," The New England Journal of Medicine, 292-545-550, 1975.

NHLBI, "Report of the Task Force on Blood Pressure Control in Children," Pediatrics, 59 (5) Supplement: 797-820, 1977.

Roberts, W.C. "Coronary Heart Disease: A Review of Abnormalities Observed in the Coronary Arteries," Cardiovascular Medicine, 2(1):29-49, 1977.

Wilmore, J.H. and J.J. McNamara, "Prevalence of Coronary Heart Disease Risk Factors in Boys, 8 to 12 Years of Age," Medicine and Science in Sports, 84:527-533, 1974.